Fish Guidance Efficiency of Modified Main Unit Gatewells: Post-Construction Evaluation at the Bonneville Dam Second Powerhouse, 2017 and 2018.

For more information related to the Background, Goals and Objectives, Methods, Justification of the Proposed Study Area, Schedule, and Facilities and Equipment Requirements, please see attachment "11_BON FGE 2017-2018 Fixed HA_Final_proposal_20160906.pdf" imbedded at the end of this document.

Background

The primary research focus of this study is to understand FGE at B2 and how gap loss affects the final FGE estimate. Also, fish managers have expressed concern with preliminary biological testing results related to the "missing fish". A better understanding of B2 FGE including performance of the transition area into the gatewell and gap loss may provide insight to post construction performance with the planned powerhouse configuration and unrestricted 1% peak efficiency operation. The B2CC was operated in conjunction with the JBS starting in 2004 allowing measurement and quantification of the effects and efficiencies of the bypass route. Evaluation of passage through the B2CC is necessary for interpretation of results. Various methods have been used to measure FGE improvements (fyke netting, hydro-acoustics, and radio tags) in the past including gap loss (DIDSON) with the addition of the prototype Gap Closure Device (GCD). Modified Units 15 and 17 had approximately 3.0–3.5% gap loss. Unmodified Unit 13 ranged from approx. 10–15% over 2003 and 2004 test periods. Therefore, the missing fish remain a major management question. As such, we propose to estimate the FGE at the modified B2 gatewells to compare to the FGE of previous studies (e.g., Ploskey et al. 2005, 2006), as well as to estimate the gap loss percentage and how it compares to estimates from previous studies (e.g., Ploskey et al. 2004, 2005, 2006; Gilbreath et al. 2014).

GOAL and OBJECTIVES

The goal of this study is to provide post-construction fish passage estimates, for research years 2017 and 2018 (2 consecutive years), of juvenile salmonids at the Bonneville Dam (BON) second powerhouse (B2) that will support decisions on long-term measures and operations to improve passage conditions at the dam for downstream salmon and steelhead. Hydroacoustic technology will be used to estimate fish passage metrics at all units/routes at B2. An acoustic camera will be used to evaluate the variation in the proportions of juvenile salmonids passing up into the gatewell and through the gap between the top of the submerged traveling screens (STS) and the turbine intake ceiling for two turbine units at B2.

During field sampling periods from April 10–May 31, 2017/2018 (spring) and June 1–

July 15, 2017/2018 (summer), the research objectives of this evaluation of fish passage will be to:

1. Estimate fish guidance efficiency (FGE) and fish passage efficiency (FPE) for spring and summer migrants at B2.
2. Estimate seasonal and diel patterns by passage route for each main unit and the B2 corner collector (B2CC).
3. Evaluate trends in FGE in response to changes in project operations and environmental conditions:
    a. Total project discharge, forebay elevation, and temperature
    b. First powerhouse (B1), spillway, and B2 discharge and percent of project flow.
    c. B2 main unit and B2CC operation.
4. Estimate vertical distribution for smolt-size fish passing inside B2 turbine intakes.
5. Estimate gap loss in the A, B, and C slots of Units 15 and 17 in spring using an underwater mobile acoustic camera.
6. Estimate gap loss by operations (lower, middle, and upper 1% peak efficiency ranges) in 15A and 15C with fixed-location underwater cameras by analyzing binned BON project operations data.
7. Synthesize FGE estimates to include JSATS, hydroacoustics, fyke net, etc., to better understand how FGE estimates have changed over the years.
8. Optional task: Utilizing an underwater acoustic camera, determine if fish are moving through the gap between the upper and lower panes of VBS and returning to the turbine intake.

METHODS

We propose to apply scientific hydroacoustic and underwater acoustic camera techniques for assessing fish passage to address the project objectives and compare estimates to previous years of study at B2 for two consecutive research years (2017 and 2018). Sampling methodology would the same for both years of study. Fixed-location hydroacoustic techniques, explained in general by Thorne and Johnson (1993) and in detail by Ploskey et al. (2003, 2005a,b), will be used to estimate fish passage rates at the turbine units and the B2CC. Split-beam transducers will be deployed in fixed-locations. Transducer sampling volumes will be strategically placed to minimize ambiguity in ultimate fish passage routes and potential for multiple detections. We plan to conduct hydroacoustic sampling 24 h/d during the data collection period: April 10, 2017 through July, 15 2017 and similarly in 2018.

BlueView® multi-beam imaging sonars (Teledyne, Bothell WA), also known as acoustic underwater cameras, will be used to estimate gap loss in Units 15 and 17, using similar methods to those of Ploskey et al. (2004). Two BlueView cameras will be fixed-mounted in the A slot of Unit 15 and the C slot of Unit 15 or Unit 17 to ensure the effects of differing operational patterns between units can be accounted for. A third repositionable BlueView will sample the A, B, and C slots of Units 15 and 17 per a randomized

schedule. The full width of the A, B, and C slots in each unit will be monitored as part of this schedule. We plan to conduct acoustic camera sampling 24 h/d during the spring data collection period from April 10, 2017 through June 7, 2017 and similarly in 2018.

Justification of the Proposed Study Area

In the 2008 Biological Opinion (BiOp), NOAA identified "Hydropower Strategy 2: RPA 18 Modify Columbia and Snake River Dams to Maximize Juvenile and Adult Fish Survival" in its Reasonable and Prudent Alternative (RPA) Table of Actions (NOAA, 2008). In particular, this strategy specifies actions that need to be executed at B2. These actions include post-construction Gatewell Modifications (e.g., screened bypass system and shallow Behavioral Guidance Structure evaluation) and RM&E Strategy 2: RPA 54 (Monitor and Evaluate Effects of Configuration and Operation Actions; NOAA, 2008). These actions were intended to meet the dam passage survival performance standard; therefore, it is critical to analyze their biological effectiveness and incorporate the analysis into the required comprehensive Evaluation Report.

Schedule

Installation of hydroacoustic and BlueView equipment will commence in late-winter 2017 once project funding is received. Efforts will be made to install equipment in tandem with B2 unit outages already planned for installation of flow control plates at B2. This will minimize the need for additional unit outages. Below is the general schedule for equipment installation, data collection, and equipment removal.

	2017														
Activity	Early Jan	Mid Jan	Late Jan	Early Feb	Mid Feb	Late Feb	Early March	Mid March	Late March	April	May	June	July	August	Days to complete
1 Badging and safety orientation															1
2 2 trailers deliverd to B2 and power supplied															1
3 Install floating barge at B2CC															2
4 Install transducers in 1 slot of each B2 main unit															7-8
5 Install underwater cameras on STS at 15A and 15C															2
6 install underwater camerage behind VBS in 15A															1
7 Data Collection Period															
8 Gear Removal															7-8

FACILITIES AND EQUIPMENT REQUIREMENTS

Two transformers and electric hookups, as well as space, for two Pacific Mobile trailers on the 90 deck of B2.

Access to the Bonneville Project from January-August 2017 for installation, data collection, and gear removal.

For further detail please refer to "2_Project Impact Statement.pdf".

11_BON FGE
2017-2018 Fixed HA